Space Weather Technical Forecast

Issued on Thursday, 17 March 2022 at 12:27 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of isolated M-flares. Slight chance of G1 minor geomagnetic storms on day 4 (20th March).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar Activity has been Low with just one C1 flare at 17/0155 UTC. There are currently three numbered sunspot regions on the visible disc. AR2965 (Beta-Gamma) located in the northwest quadrant, remains the most complex though with decay observed in some of the minor intermediate spots. AR2967 in the northeast quadrant, remains a simple Hsx/Alpha type, showing slight decay. A new area towards the northeast limb has a few minor pores and has been numbered AR2971 Bxo/Beta.
Two filament eruptions and subsequent CMEs were observed on the UTC afternoon on 16th. One off the western limb is a clear miss, however the other from the east of the Sun may give a glancing blow at Earth on day 4 (20th March). No other Earth-directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by DSCOVR at L1, have been slowly declining from slightly elevated to background levels, ending the period around 350 km/s. Density was at average to below average levels, around 3-6 ppcc. The strength of the interplanetary magnetic field (IMF), Bt, was weak 2-5nT. The north-south component, Bz, was weak and ranged from -4nT to +3nT. Phi angle was mostly negative (towards the sun). Geomagnetic activity was Quiet (Kp 2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at background. The high energy electron flux (greater than 2 MeV) has been at predominantly at background levels. The 24-hour integrated electron fluence was well below the Active (1e8 integrated pfu) threshold. Observed fluence at 17/0000 UTC was 1.66e6 integrated pfu.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be at mostly Low or Very Low levels with an ongoing chance of an isolated M-class flare, mainly from AR2965.

Solar Wind / Geomagnetic Activity: There is one slow weak CME observed from a filament lift off the southern disc on 13 March. This will likely pass south of the Earth, but may give a glancing impact on day 1 (17th). The filament eruptions and subsequent CMEs from the northeast quadrant on 16th have been modelled in Enlil. The CME off the west limb is a clear miss, but the CME from the filament eruption in the east may give a glancing blow on day 4 (20th March). Also, the next potential coronal hole fast wind arrival is likely to be on day 4 (20th March) from CH66/-, a northern extension of the southern crown coronal hole. Geomagnetic activity is expected to be mostly Quiet with occasional Unsettled intervals until day 4 when there is an increased likelihood of Active intervals and a chance of G1 minor geomagnetic storms.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain predominantly at background levels, although there is a slight chance of an increase in response to any larger flares that may occur. The high energy (greater than 2 MeV) electron flux is currently at predominantly background levels. No definite sources of enhancement are currently expected in the period until the next coronal hole high speed stream from CH66/- arrives, most likely day 4 (20th). The electron fluence is currently well below the Active level, and expected to remain at this level but with a possible rising trend late in the period.

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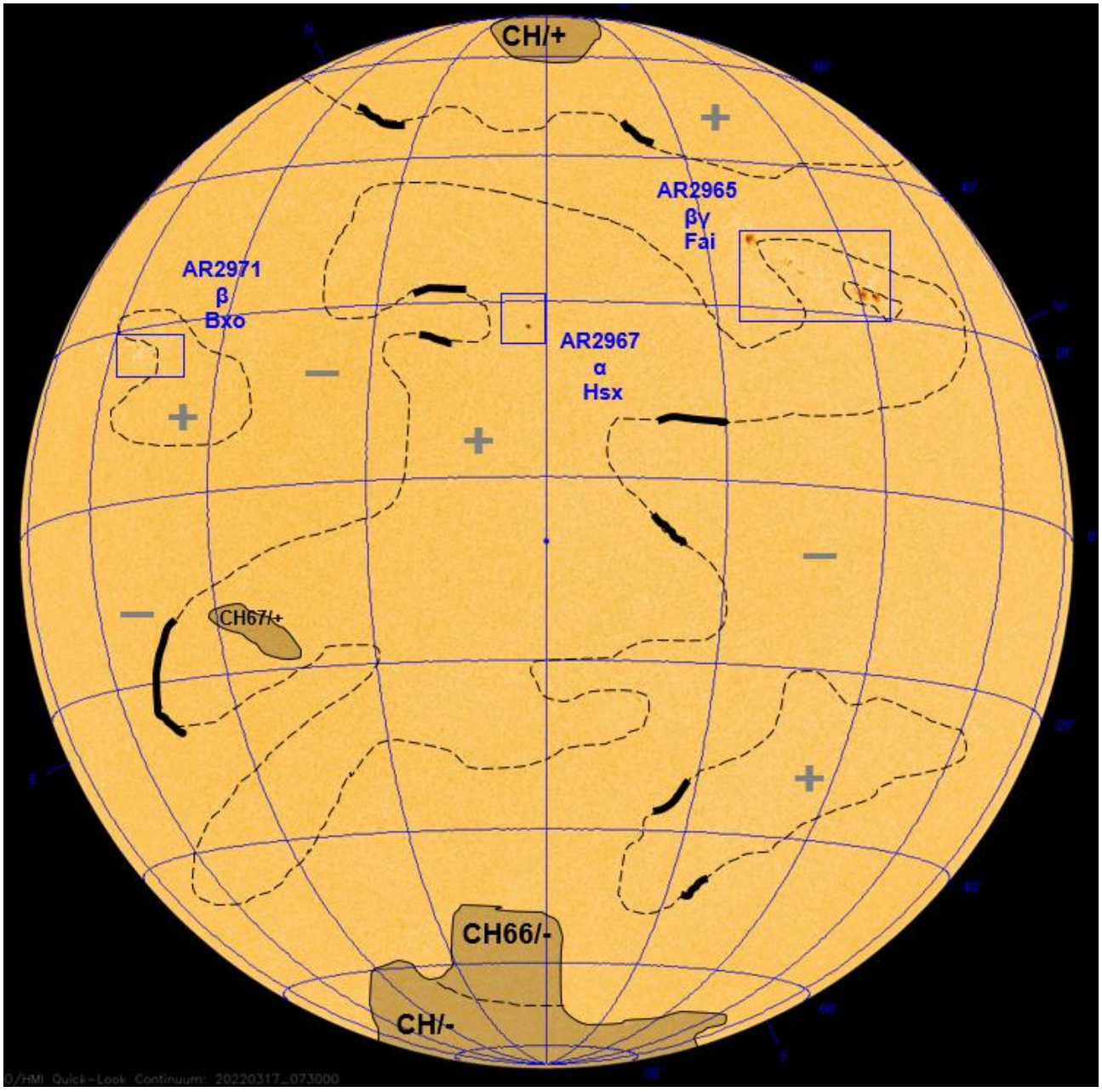
Figure 1. Solar Analysis Valid 17/0800UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

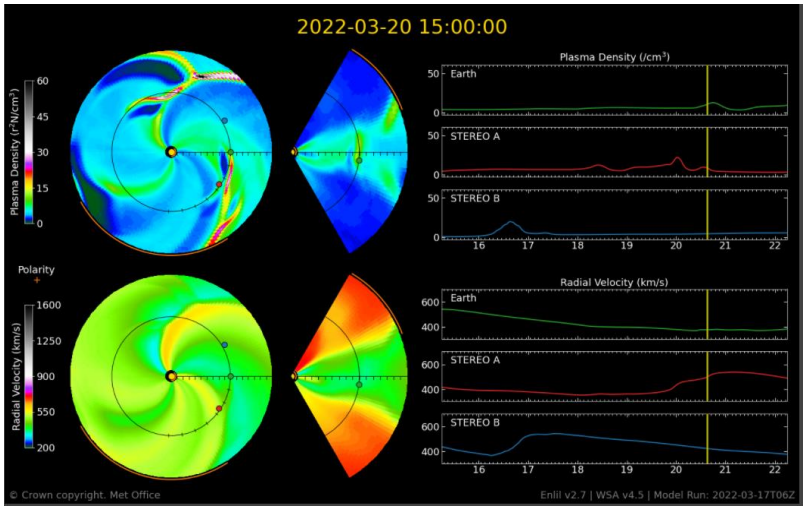
Solar winds are currently at background. There is a CME expected to pass to the south of Earth on day 1 (17th), from a filament lift on the 13th. This has a low chance of bringing a glancing impact, and giving a chance of Unsettled to Active intervals and a very slight chance of G1 Minor Storm intervals.
The filament eruptions and subsequent CMEs from the northeast quadrant on 16th have been analysed. The CME off the west limb is a clear miss, but the CME from the filament eruption in the east may give a glancing blow on day 4 (20th March). Also, the next potential coronal hole fast wind arrival is likely to be on day 4 (20th March) from CH66/-, a northern extension of the southern crown coronal hole. Geomagnetic activity is expected to be mostly Quiet with occasional Unsettled intervals until day 4 when there is an increased likelihood of Active intervals and a chance of G1 minor geomagnetic storms.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	5	1	1	30
Strong	G3	No	1	1	1	2
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
16/2020UTC	Partial	Filament eruption	NE quadrant	400	20/1500UTC	Glancing blow. Limited shock expected.

Figure 2: MOSWOC Enlil shows the glancing CME around 15000UTC on the 20th.



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Radio Blackouts - X-Ray Flares:

Solar Activity has been Low, with one C1 flare. There are currently three numbered sunspot regions on the visible disc. AR2965 (Beta-Gamma) located in the northwest quadrant, remains the most complex. Some decay has been observed within the minor intermediate spots. AR2967 in the northeast quadrant, remains a simple Hsx/Alpha type, showing slight decay. A new region in the northeast, AR2971, is a weak and stable Bxo/ Beta.

STEREO-A imagery shows a possible returning region which may turn onto the northeast limb later in the period.
Solar activity is forecast to continue mostly Low with a chance of further isolated M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	25	25	25
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (10MeV) measured at GOES-16 has remained at background levels. Any significant flares from AR2965 may give a potential enhancement, however only a slightly chance of reaching the S1 level is currently forecast. Otherwise background levels are expected to persist.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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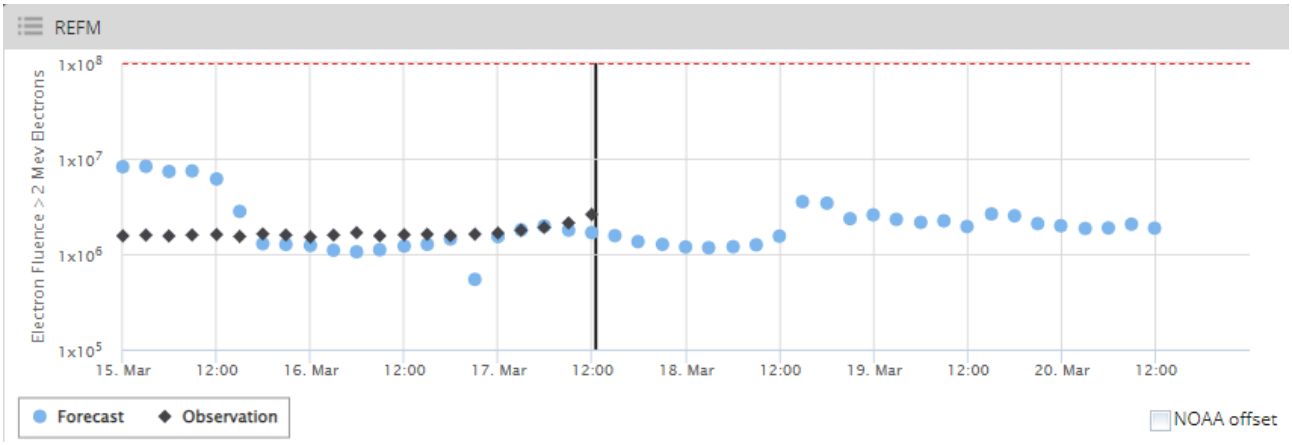
High Energy Electrons Event (≥ 2MeV):
The high energy (greater than 2 MeV) electron flux as observed at GEO by GOES-16 is currently at predominantly background levels. No definite sources of enhancement are currently expected in the period until the next coronal hole high speed stream from CH66/- arrives, most likely day 4 (20th).

The associated 24 hour electron fluence is currently well below the Active level, and expected to remain at this level but with a possible rising trend late in the period. This is supported by REFM, which appears to be giving reasonable guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: MOSWOC REF Model forecasting fluence levels below 1e8 Active level.



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